
Additions to our knowledge of the genus *Albatrellus* (Basidiomycota) in China

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Albatrellus specimens from China were studied systematically. Nineteen species were identified, including three species new to science. The three new species are described and illustrated. *Albatrellus fumosus* has fasciculate basidiomes, grayish brown pileus, simple-septate hyphae and small amyloid basidiospores. *Albatrellus microcarpus* is characterized by single basidiome, pale yellowish white squamulose pileus, simple-septate hyphae and small amyloid basidiospores. *Albatrellus tibetanus* is distinguished from other *Albatrellus* species by its caespitose basidiomes, white to cream pileus with dense deep brown squamules, simple-septate hyphae and small amyloid basidiospores. A key to the *Albatrellus* species known from China is also given.

Key words: distribution, new species, taxonomy

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Introduction

The genus *Albatrellus* was established in 1821. The basidiomes typically grow from the soil in the forest associated with trees. They are fleshy, stipitate, the pileus surface is glabrous to scaly, and the hymenophore poroid. Microscopically, the hyphal system is monomitotic, with simple septa or clamp connections; basidiospores are smooth, broadly ellipsoid to subglobose, up to 12 µm long, non-amyloid to amyloid. Some species are edible and can be found in markets (Miller and Miller, 1980; Wang and Liu, 2002; Wang *et al.*, 2004). In recent years some novel and useful compounds have been extracted from some species. These compounds have special biological activities and may be used as medicines in the future (Hirata and Nakanishi, 1950; Chaumont and Simeray, 1982; Kawagishi *et al.*, 1996; Ding *et al.*, 2001; Nukata *et al.*, 2002; Hellwig *et al.*, 2003; Yang *et al.*, 2003; Qing *et al.*, 2004).

Originally, *Albatrellus* was placed in the order *Polyporales* (e.g. Kirk *et al.*, 2001). Based on phylogenetic analyses of DNA sequences it was shown that the genus *Albatrellus* is

polyphyletic. *Albatrellus syringae* and *A. peckianus* were placed outside the clade containing other *Albatrellus* species (*A. ellisii*, *A. flettii* and *A. skamianus*) and species of *Russulaceae* in a phylogenetic tree inferred from a small region of the mitochondrial large subunit rRNA gene (Bruns *et al.*, 1998). The polyphyly of *Albatrellus* was confirmed by phylogenetic analyses of other rDNA regions. The ectomycorrhizal species (e.g. *A. flettii* and *A. skamianus*) are clustering in the Russuloid clade while the saprotrophic species (e.g. *A. syringae*) are accommodated in the Polyporoid clade (Hibbett and Binder, 2002; Hibbett *et al.*, 2005; Miller *et al.*, 2006; Zmitrovich *et al.*, 2006). Although the molecular data show that the saprotrophic species (e.g. *A. syringae* and *A. peckianus*) should be excluded from *Albatrellus*, there is no published material concerning the placement of them at generic level. To transfer the saprotrophic species to a known genus or propose a new genus for them still needs further study, so we include *A. syringae* and *A. peckianus* in this treatment.

Up to now, more than 20 species have been reported from throughout the world

(Ryvarden and Johnsen, 1980; Gilbertson and Ryvarden, 1986; Ryvarden and Gilbertson, 1993; Ginns, 1997; Núñez and Ryvarden, 2001; Ryman *et al.*, 2003; De, 2005; Zheng and Liu, 2006; Cui *et al.*, 2008). Eighteen species were recorded from China (Deng, 1963; Zheng *et al.*, 1992; Bi *et al.*, 1994; Yuan and Sun, 1995; Mao, 1998; Zhao *et al.*, 1998; Zheng *et al.*, 2004; Zheng and Liu, 2006; Cui *et al.*, 2008), but some descriptions are ambiguous and need reconfirmation. Some species have been excluded from the genus or treated as synonym of other known species (Zheng and Liu, 2005; Zheng and Liu, 2006) after studying their type specimens. *Albatrellus* specimens collected from China have been studied systematically and compared with specimens from America, Europe and Japan. As a result, nineteen species were identified, which included three new species and one new record for China.

Materials and methods

The descriptions appear in alphabetical order by the species epithet. The data were drawn primarily from specimens at KUN (HKAS), HMAS and HMIGD. Abbreviations for herbaria where specimens are preserved are according to Index Herbariorum (Holmgren and Holmgren, 1998). The localities listed under 'distribution' are based on the examined material and the distribution data in the references.

Microscopic examinations and measurements were made from freehand sections mounted in 5-10% KOH, 1% Congo red and Melzer's reagent (iodine 0.5 g, potassium iodide 1.5 g, chloral hydrate 22 g, distilled water 22ml). Dimensions for basidiospores are given using notation of form (a-)b-c(-d). The range b-c contains a minimum of 90% of the measured values. Extreme values—*e.g.*, a or d—are given in parentheses. \bar{Q} is used mean 'length/width ratio' of basidiospores in side view, \bar{Q} (in bold face) means average \bar{Q} of all basidiospores measured \pm sample standard deviation (Yang and Zhang, 2003).

Results

A key to the Albatrellus species known from China

- 1 Hyphae with clamp connections..... 2
- 1 Hyphae with simple septa..... 9
- 2 Basidiospores no more than 6 μm long..... 3
- 2 Basidiospores more than 7 μm long..... 6
- 3 Basidiospores amyloid..... 4
- 3 Basidiospores non-amyloid 5
- 4 Pileus surface pale orange, usually with olivaceous tint, but no blue tint; basidiospores 3.5-6 \times 2.5-4.4 μm *A. confluens*
- 4 Pileus surface and stipe grayish blue, some areas of yellowish green, but the blue color often disappeared in old specimens or during drying; pore surface and context apricot colored; basidiospores 3.5-6 \times 2.5-4.5 μm *A. flettii*
- 5 Pileus surface yellow, azonate; pore surface with red tints in dry specimens; basidiospores 3.5-4.5 \times 2.5-3.5 μm ; often growing under trees *A. peckianus*
- 5 Pileus surface yellow to ochraceous, sometimes faintly zonate; pore surface with no red tints after drying; basidiospores 3.5-4.5 \times 2.5-3.5 μm ; often growing in lawns with no trees nearby *A. syringae*
- 6 Pileus surface nearly glabrous or cracked into very small scales, olivaceous yellow to dull yellow with ochraceous tints; basidiospores 7.5-12 \times 5-8 μm , non-amyloid..... *A. yunnanensis*
- 6 Pileus surface cracked or with very coarse scales..... 7
- 7 Pileus surface grayish-brown, fuliginous to nearly black, cracked into small scales; basidiospores 7-9 \times 5-6.5 μm , non-amyloid *A. skamanius*
- 7 Pileus surface color not as above, with distinct scales 8
- 8 Pileus surface yellow or greenish yellow, sometimes brownish yellow, becoming grassy green when touched or bruised, with thick and coarse scales; basidiospores 7-10 \times 5.5-8 μm , non-amyloid *A. ellisii*
- 8 Pileus surface grayish brown to reddish brown, never become grassy green when bruised, with fibrillose scales; basidiospores 7-10 \times 5.5-7 μm , non-amyloid *A. pes-caprae*
- 9 Pileus surface brown to black, viscid, with a resinous cuticle, glossy after drying; pore surface white; pileipellis hyphae ends clavate; basidiospores 4-5.5 \times 3.5-5 μm , non-amyloid..... *A. yasudae*
- 9 Pileus surface without a viscid resinous cuticle..... 10
- 10 Pileus petaloid; basidiomes caespitose..... 11
- 10 Pileus not petaloid; basidiomes single or confluent.... 12
- 11 Pileus surface golden yellow or with pale brownish tint; pore surface white to cream, becoming red after preserved in herbarium for some time; basidiospores 3.5-5 \times 3-4 μm , non-amyloid *A. dispansus*

- 11 Pileus surface grayish white, pale gray to grayish brown; pore surface white, discoloring dirty blood red when bruised; basidiospores $3.5-4.5 \times 2.5-3.5 \mu\text{m}$, amyloid.....*A. fumosus*
- 12 Pileus surface and pore surface blue to grayish blue; basidiospores $4-5.5 \times 3-4.5 \mu\text{m}$, non-amyloid.....*A. caeruleoporus*
- 12 Pileus surface white, pale tan, greenish yellow to yellowish brown13
- 13 Pileus surface and stipe greenish yellow, almost glabrous or with small scales; pore surface white or with yellowish tint; basidiospores $5-7 \times 4-5.5 \mu\text{m}$, non-amyloid to weakly amyloid*A. cristatus*
- 13 Pileus surface white, pale tan to yellowish brown ..14
- 14 Basidiospores non-amyloid; pileus surface cream white to buff; growing in *Picea* forest.....*A. ovinus*
- 14 Basidiospores amyloid15
- 15 Pileus surface with distinct squamules or scales16
- 15 Pileus surface nearly glabrous or with minute squamules17
- 16 Pileus surface pale brown, with distinct small darker scales; stipe 4-9cm long, apricot colored with a black base; basidiospores $4-5.5 \times 3-4.5 \mu\text{m}$*A. tianshanicus*
- 16 Pileus surface white to cream, with blackish to deep brown squamules; pore surface white; stipe 2-3 cm long, dirty white to brown; basidiospores $4-5 \times 3-4 \mu\text{m}$*A. tibetanus*
- 17 Pileus surface white, with pale brown, fibrillose squamules; pore surface becoming reddish brown after drying; basidiospores $3.5-4.5 \times 2.5-3.5 \mu\text{m}$*A. microcarpus*
- 17 Pileus surface white, nearly glabrous; pore surface never becoming reddish brown after drying.....18
- 18 Pileus surface first white, becoming citric yellow when matured, discoloring yellow when bruised; basidiospores $4.5-5.5 \times 3.5-4.5 \mu\text{m}$; growing in *Picea* forests.....*A. citrinus*
- 18 Pileus surface white, discoloring orange when bruised; basidiospores $4-5 \times 3-3.5 \mu\text{m}$; growing in *Pinus* forests..*A. subrubescens*

A conspectus of species

Albatrellus caeruleoporus (Peck) Pouzar, Fol. Gebot. Phytotaxon. 1: 358 (1966).

Basionym: *Polyporus caeruleoporus* Peck, N.Y. State Mus. Ann. Rept. 26: 68 (1874).

Known distribution: East Asia (Núñez and Ryvarden, 2001) and North America (Gilbertson and Ryvarden, 1986-1987; Ginns, 1994; Ginns, 1997). In China known from Yunnan and Sichuan (Yuan and Sun, 1995; Zhang, 1999).

Material examined: **SICHUAN:** Kangding, Qiaba, in *Larix* forest, alt. 3900m, 4 August 1997, Ming-Sheng Yuan 2850 (HKAS 31294).

Notes: *A. caeruleoporus* is distinguished from other species by its overall grayish blue basidiomes when fresh, simple-septate hyphae and small non-amyloid basidiospores.

Albatrellus citrinus Ryman, Mycol. Res.107: 1245 (2003).

Known distribution: Europe (Ryman *et al.*, 2003). In China known from Tibet (Zheng *et al.*, 2004).

Material examined: **TIBET:** Ridong, in *Picea* forest, alt. 3200m, 13 September 1982, Mu Zang 984 (HKAS 10748).

Notes: The diagnostic characters of *A. citrinus* are white basidiomes becoming citric yellow when mature, small amyloid basidiospores and habitat under *Picea*.

Albatrellus confluens (Alb. & Schwein.) Kotl. & Pouzar, Česká Mykol. 11: 154 (1957).

Basionym: *Boletus confluens* Alb. & Schwein., Consp. Fung., in Lusatae Superioris Agro Niskiensi Crescentium e Methodo Persooniana (Leipzig): 244 (1805).

Known distribution: East Asia, North America and Europe (Ryvarden, 1976; Gilbertson and Ryvarden, 1986-1987; Ryvarden and Gilbertson, 1993; Ginns, 1994; Ginns, 1997; Núñez and Ryvarden, 2001). In China known from Sichuan, Yunnan, Tibet, Qinghai, Jiangxi and Jilin (Deng, 1963; Yuan and Sun, 1995; Zhang, 1999; Zhang, 1999; Mao, 2000).

Material examined: **YUNNAN:** Kunming Hepingxincun wild mushroom market, 26 August 2002, Huandi Zheng 02-136 (HKAS21572); same market as above, 1 August 2003, Huan-Di Zheng 03-367 (HKAS 30880); same market as above, 16 September 2003, Huandi Zheng 03-474 (HKAS 30881); Jingdong local market, 31 July 1998, Xiang-Hua Wang 559 (HKAS 32919); Yongping local market, 8 August 2000, Xiang-Hua Wang 1145 (HKAS 36859); Wuding Changchong, 6 July 2000, Xiang-Hua Wang 1188 (HKAS 37158); Wuding Changchong, 11 September 2004, Huan-Di Zheng 04-679 (HKAS 48292); Chuxiong, Zixi mountains national forest park, alt. 2380m, 13 August 2004, Huan-Di Zheng 04-557 (HKAS 48299); Chuxiong, Zixi mountains national forest park, alt. 2380m, 15 August 2004, Huan-Di Zheng 04-581 (HKAS 48291); Nanhua wild mushroom market, 1 IX 2002, Huan-Di Zheng 02-168 (HKAS 21573); 14 August 2004, Huan-Di Zheng 04-577 (HKAS 48290); **SICHUAN:** Yajiang, alt. 3600m, 23 August 1984, Ming-Sheng Yuan 761 (HKAS 15500); Kangding, Wenba, alt. 3100 m, 27 August 1984, Ming-Sheng Yuan 852 (HKAS 15543); Daocheng, Julong, in *Pinus* forest, alt. 3400m, 9 August

1984, Ming-Sheng Yuan 551 (HKAS 15702); Xiangcheng, in the vicinity of Riyang, alt. 3600m, 10 July 1998, Zhu-Liang Yang 2249 (HKAS 32219); Xiangcheng, Reda, alt. 3500m, 16 July 1998, Zhu-Liang Yang 2339 (HKAS32276); Nanping, Jiuzhaigou, alt. 1800m, 16 September 1998, Ming-Sheng Yuan 3744 (HAKS 33331); Xichang, 8 August 1984, Ming-Sheng Yuan 340 (HKAS19909); 8 August 1984, Ming-Sheng Yuan 380 (HKAS19910); **TIBET:** Changdu, Leiwuqi, under *Picea* forest, alt. 4400m, 15 August 1976, Mu Zang 554 (HKAS 5554); Changdu, Leiwuqi, in the vicinity of Sangduo village, alt. 4200m, 12 August 2004, Zai-Wei Ge 353 (HKAS 46133); Jiangda county, tongpu, alt. 3300m, 2 August 2004, Zhu-Liang Yang 4278 (HKAS 45657); 2 August 2004, Zai-Wei Ge 266 (HKAS 46046).

Notes: *A. confluens* is different from other species by confluent orange basidiomes, clamped hyphae and small amyloid basidiospores. This is a quite common and popular, edible species for sale in southwestern Chinese markets.

Albatrellus cristatus (Schaeff.) Kotl. & Pouzar, *Česká Mykol.* 11: 154 (1957).

Basionym: *Boletus cristatus* Schaeff., *Fung. Bavar. Palat.* 4: 316 (1774).

Known distribution: East Asia, North America and Europe (Gilbertson and Ryvar den, 1986; Ryvar den and Gilbertson, 1993; Núñez and Ryvar den, 2001). In China known from Yunnan, Sichuan, Guizhou, Jilin, Heilongjiang, Gansu, Qinghai, Tibet, Guangdong, Guangxi, Zhejiang, Henan, Hebei, Shanxi, Neimenggu (Li, 1980; Ryvar den *et al.*, 1986; Li *et al.*, 1991; Mao, 1998).

Material examined: **YUNNAN:** Kunming, Miaogao temple, 11 August 2005, Huan-Di Zheng 05-936 (HKAS 49765); Chuxiong, Zixi mountains national forest park, 1 August 2005, Huan-Di Zheng 05-888 (HKAS 49801); Yongren county, September 2004, Fu-Qiang Yu 1259 (HKAS 48300); September 2004, Fu-Qiang Yu 1260 (HKAS 48301); Luquan, Pingshan, August 1991, Xue-Xi Liu 912 (HKAS 23614); Jianchuan, alt. 2750 m, 7 September 1983, Wen-Kang Zheng 83126 (HKAS 12075); Binchuan, Jizu mountains, alt. 2550 m, 7 August 1985, Guo-Ping Xiao 399 (HKAS 17126); 17 August 1985, Guo-Ping Xiao 738 (HKAS 17198); Gaoligongshan, Baihualing, alt. 1900m, 13 August 2002, Huan-Di Zheng 02-51 (HKAS 21576); Gaoligongshan, Baihualing, alt. 1900m, 14 August 2002, Pei-Gui Liu 4639 (HKAS 3635); Simao, Laiyang, Liaowangtai, alt. 1680m, 25 June 2000, Mu Zang 13497 (HKAS 36050); Simao, N 22.48°, E 100.58°, 13 October 1999, Xiao-Qing Zhang 2976 (HMAS 78374); Xishuangbanna, Dadugang, 5. July 2003, Huan-Di Zheng 02-252 (HKAS 25100); Xishuangbanna, Dadugang, 30 August 2004, Huan-Di Zheng 04-604 (HKAS 48293); Xishuangbanna, Dadugang, 30 August 2004, Huan-Di Zheng 04-605 (HKAS 48294); Xishuangbanna, Dadugang, 30 August 2004, Huan-Di

Zheng 04-606 (HKAS 48295); Xishuangbanna, Dadugang, 30 August 2004, Huan-Di Zheng 04-607 (HKAS 48296); Xishuangbanna, Dadugang, 31 August 2004, Huan-Di Zheng 04-620 (HKAS 48297); Xishuangbanna, Mengla, Longmen, 28. September 1974, Mu Zang (HKAS 1925); **SICHUAN:** Xi Chang, Lou Ji Mts., alt. 2000 m, 4 October 1983, Ming-Sheng Yuan 275 (HKAS 11981); Xichang, Lojishan, alt. 2000 m, 9 August 1986, Yuan M. S. 1253 (HKAS 18222); **HENAN:** Lushi, July 1968, Jian-Zhe Ying *et al* 157 (HMAS 53936); **JIANGXI:** Wuning, July 1936, Shu-Qun Deng 14941 (HMAS 17437); **GUANGDONG:** Shixing, Zhangdongshui reserve, 28 June 1984, Guo-Yang Zheng (HMIGD 6587); Yangshan, Chengjia, Taipingdong, Niusekeng, under mixed forest, alt. 900-1100m, 19 September 1985, Guo-Yang Zheng (HMIGD 9243).

Notes: *A. cristatus* can be separated from other *Albatrellus* species by its greenish yellow pileus surface, simple-septate hyphae and medium-size non-amyloid to weakly amyloid basidiospores. This is a common species in China. It was found in large populations under broad and needle leaves mixed forest.

Albatrellus dispansus (Lloyd) Canf. & Gilb., *Mycologia* 63: 965 (1971).

Basionym: *Polyporus dispansus* Lloyd, *Mycol. Writ.* 3 (Syn. Stip. Polyporoids): 192 (1912).

Known distribution: East Asia and North America (Gilbertson and Ryvar den, 1986; Ginns, 1997; Núñez and Ryvar den, 2001); in China known from Yunnan, Sichuan, Tibet and Fujian (Yuan and Sun, 1995; Mao, 1998; Zhang, 1999).

Material examined: **YUNNAN:** Kunming, Miaogao Temple, 11 August 2005, Huan-Di Zheng 05-935 (HKAS 49764); Songming, Aziying, 14 July 1981, Da-Gan Ji (HKAS 7639); Songming, Aziying, Muyang, Baizichong, alt. 2280m, 8 August 2005, Huan-Di Zheng 05-933 (HKAS 49763); Yiliang, Goujie, 20 October 2004, Huan-Di Zheng 04-734 (HKAS 48317); Chuxiong wild mushroom market, 16 July 1998, Xiang-Hua Wang 385 (HKAS 32959); Wuding wild mushroom market, 12 August 1999, Xiang-Hua Wang 735 (HKAS 35821); Wuding wild mushroom market, 14 August 2004, Huan-Di Zheng 385 (HKAS 25107); Wuding, Changchong, 13 August 1999, Qing-Bin Wang 77 (HKAS 3634); Wuding, Changchong, under *Pinus yunnanensis*, alt. 2000 m, 19 September 2001, Fu-Qiang Yu 765 (HKAS 38856); Nanhua Wild mushroom market, 9 August 2000, Fu-Qiang Yu 129 (HKAS 36932); Nanhua Wild mushroom market, 9 August 2000, Xiang-Hua Wang 1152 (HKAS 37106); Nanhua Wild mushroom market, 13 August 2003, Huan-Di Zheng 372 (HKAS 25106); Nanhua Wild mushroom market, August 2000, Lü 9 (HKAS 36877); Nanhua Wild mushroom market, 16 August 2004, Huan-Di Zheng 04-584 (HKAS 48298); Nanhua Wild mushroom market, 3 August 2005, Huan-Di Zheng 05-928 (HKAS 49759); Nanhua Wild

mushroom market, 4 August 2005, Huan-Di Zheng 05-931 (HKAS 49762); Lufeng Wild mushroom market, 13 September 2004, Huan-Di Zheng 04-719 (HKAS 48302); Lufeng Wild mushroom market, 13 September 2004, Huan-Di Zheng 04-720 (HKAS 48303); Guangnan, alt. 1450 m, 28 July 1983, W-K Zheng 8322 (HKAS 12042); Zhongdian, Dabao temple, alt. 3500 m, in *Pinus densata* & *Betula platyphylla* forest, 20 September 1993, Pei-Gui Liu 2174 (HKAS 27005); Lijiang, 2000, Jun-Hou Lü 4 (HKAS 41097); Dali, Yangbi, alt. 1800 m, 16 August 1959, Qing-Zhi Wang 1019 (HMAS 25282); Dali, Yangbi, alt. 1800 m, 16 August 1959, Qing-Zhi Wang 1021 (HMAS 26252); Dali, Yangbi, 20 August 1959, Qing-Zhi Wang 1056 (HMAS 26628); **SICHUAN**: Xichang, 8 August 1984, Ming-Sheng Yuan 340 (HKAS 19909); Xichang, Luolaoshan, Xianrendong, alt. 2000 m, 18 July 1992, Pei-Qiong Sun 1826 (HKAS 25702); **TIBET**: Xiachayu, occurred together with *Marasmius equicrinis* F. Muell. ex Berk. (= *M. graminum* (Lib.) Berk. & Br.) in mixed forest, 1 September 1976, Mu Zang 690 (HKAS 5690); Xiachayu, 1 September 1976, Mu Zang 723-4 (HKAS 5723d).

Notes: *A. dispansus* is a distinctive species by its pale yellow petaloid basidiomes, simple-septate hyphae and small non-amyloid basidiospores. This is a quite common and popular, edible species for sale in Chinese markets. The largest basidiome ever seen was 30 cm broad.

Albatrellus ellisii (Berk.) Pouzar, Fol. Geobot. Phytotax. 1: 357 (1966).

Basionym: *Polyporus ellisii* Berk., Grevillea 7 (no.41): 4 (1878).

Known distribution: East Asia and North America (Gilbertson and Ryvarden, 1986; Núñez and Ryvarden, 2001); in China known from Yunnan and Sichuan (Mao, 1998; Zhao *et al.*, 1998).

Material examined: **YUNNAN**: Lijiang, Lidiping, August 1976, Xue-Xi Liu (HKAS 2668); Lijiang, Heibaishui, August 1976, Xue-Xi Liu (HKAS 2695); Lijiang, Yulong mountains, Heibaishui, August 1976, Xue-Xi Liu (HKAS 2741); Lijiang, Xinzhuixiang, under *Pinus yunnanensis*, alt. 2400 m, 18 August 1984, Ke-Ke Chen & Yu Xuan 3 (HKAS 14196); Lijiang, Tiejia mountains, 4 August 1985, Mu Zang 10303 (Horak 2904, HKAS 15182); Lijiang, Yulong mountains, Hutiaoxia, alt. 2000 m, 5 October 1986, Zang Mu 10766 (HKAS 17816); Lijiang, Yulong mountains, alt. 3000m, 10 September 1999, Pei-Qiong Sun 4517 (HKAS 34931); Lijiang Yulong mountains, 1975, Yuan-Teng Chen 2792 (HKAS 40206); Lijiang, Lidiping, alt. 3000 m, 16 August 1976, Xue-Xi Liu (HKAS 40454); Lijiang, 1 August 2000, Jun-Hou Lü 8 (HKAS 41101); Songming, Aziying, 14 July 1981, Da-Gan Ji (HKAS 7637); Dali Cangshan Mts., Zhong He Feng, 13 September 1983, Guan 1 (HKAS 11959); Dali, September 1983, Yu-Xuan (HKAS 12092); Binchuan

county, Jizu mountains, under mixed forest on ground, alt. 2900 m, 15 August 1985, Xiao Guoping 718 (HKAS 16936); Kunming, Hepingxincun wild mushroom market, 26 August 2002, Huan-Di Zheng 02-133 (HKAS 21575); Kunming, Hepingxincun wild mushroom market, 1 August 2003, Huan-Di Zheng 368 (HKAS 25103); Kunming, Hepingxincun wild mushroom market, 16 September 2003, Huan-Di Zheng 475 (HKAS 25104); Kunming, Xundian, Majie market, 6 September 2004, Huan-Di Zheng 04-637 (HKAS 48308); Jingdong, 14 September 1978, Da-Gan Ji (HKAS 22275); Kunming, Xishan, on ground, August 1990, Xiao-lan Mao (HMAS 72854); Jingdong market, alt. 1200m, 25 August 1991, Pei-Gui Liu 1032 (HKAS 23810); Jingdong market, 27 August 1991, Pei-Gui Liu 1087 (HKAS 23812); Jingdong market, alt. 1260m, 25 August 1991, Gang Song 311 (HKAS 24082); Jidong market, 28 July 1998, Wang X-H 467 (HKAS 32905); Jinggu, Yongping, under *Pinus*, 22 August 1991, Pei-Gui Liu 1010 (HKAS 23811); Lanping market, 8 July 2003, Huan-Di Zheng 345 (HKAS 25101); Lanping market, 8 July 2003, Huan-Di Zheng 346 (HKAS 25102); 16 September 2003, Huan-Di Zheng 476 (HKAS 25105); Yuxi, Shuatou market, 22 September 1997, Xiang-Hua Wang 97-137 (HKAS 31748); Wuding, Chadian, under *Pinus*, 6 August 1998, Xiang-Hua Wang 656 (HKAS 32925); Yongping county market, 9 August 2000, Xiang-Hua Wang 1146 (HKAS 37134); Wuding, Shizi mountains, under *Pinus yunnanensis*, alt. 2200m, 20 August 2000, Fu-Qiang Yu 220 (HKAS 38851); Chuxiong, Zixi mountains national forest park, under *Pinus yunnanensis*, alt. 2200m, 30 August 2000, Fu-Qiang Yu 330 (HKAS 38852); Chuxiong, Zixi mountains national forest park, under *Pinus yunnanensis*, alt. 2200 m, 12 July 2001, Fu-Qiang Yu 444 (HKAS 38853); Nanhua, Wujie, alt. 2500m, 23 September 2004, Juan Chen 221 (HKAS 45437); Nanhua wild mushroom market, 16 August 2004, Huan-Di Zheng 04-586 (HKAS 48305); Nanhua wild mushroom market, 14 August 2004, Huan-Di Zheng 04-576 (HKAS 48307); Nanhua wild mushroom market, 3 August 2005, Huan-Di Zheng 05-929 (HKAS 49760); Dali, Jianchuan, Shibao mountains, alt. 2500m, 22 July 2004, Huan-Di Zheng 04-489 (HKAS 48304); Lufeng wild mushroom market, 9 August 2004, Huan-Di Zheng 04-536 (HKAS 48306); Yongsheng, 25 June 1955, Y 158 (HMAS 18173); 1938, He-sheng Yao (HMAS 17487); **SICHUAN**: Xichang, Luoji mountains, alt. 2700m, 15 August 1983, Ming-Sheng Yuan 129 (HKAS 11780); Xichang, 13 July 1978, Xu Lian-Wang -17 (HMAS 54135); Xiangcheng Lu Shan, alt. 2000m, 4 October 1983, Ming-Sheng Yuan 272 (HKAS 11958); bought from local people, 185 (HMAS 39654).

Notes: *A. ellisii* is characterized by scaly pale yellow pileus surface, clamped hyphae and large non-amyloid basidiospores. This species is quite a popular and delicious edible fungus that is cooked according to a special method in southwestern China. Sometimes, it is sold in large amounts in the wild edible fungi markets of middle Yunnan Province, such as Chuxiong, Nanhua and Wuding.

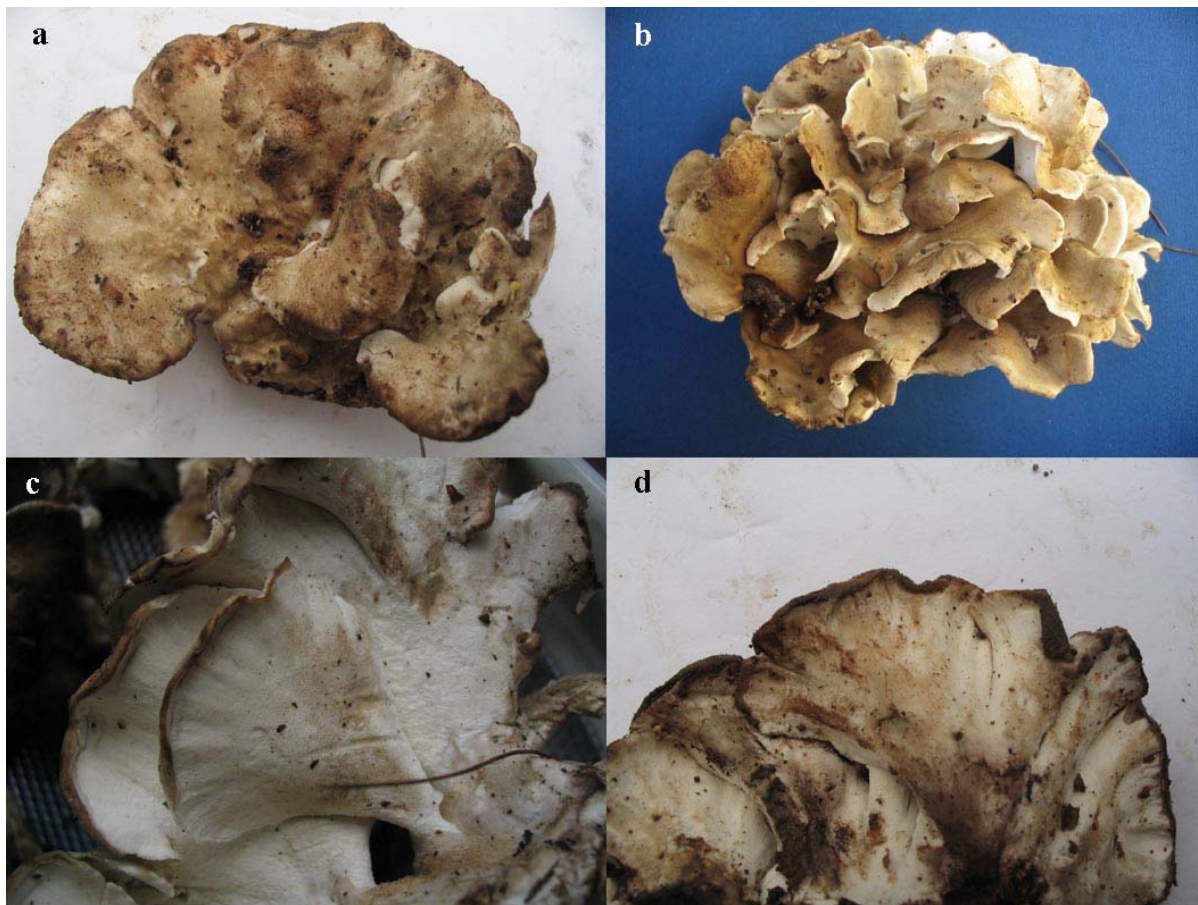


Fig. 1. *Albatrellus fumosus* H.D. Zheng & P.G. Liu Fresh basidiomes. **a, d.** HAKS 48289 (**holotype**). **b.** HAKS 49761. **c.** HAKS 49758.

Albatrellus flettii Morse ex Pouzar, Česká Mykol. 26: 198 (1972).

Known distribution: East Asia and North America (Gilbertson and Ryvarden, 1986; Núñez and Ryvarden, 2001; Zheng *et al.*, 2004); in China known from Yunnan and Sichuan (Zheng *et al.*, 2004; Zheng 2006).

Material examined: **YUNNAN:** Kunming, Hepingxincun wild mushroom market, 26 August 2002, Huan-Di Zheng 02-128 (HKAS21574); Chuxiong, Zixi mountains national forest park, alt. 2400m, 13. August 2004, Huan-Di Zheng 04-556 (HKAS 48309); Nanhua, wild mushroom market, 14 August 2004, Huan-Di Zheng 04-574 (HKAS 48310); Pingbian, Dawei mountains, alt. 2100m, 4 July 1992, Pei-Gui Liu 1246 (HKAS 25925); **SICHUAN:** Muli, 17 August 1992, Pei-Gui Liu & Ming-Sheng Yuan 1401 (HKAS 25703); Muli, 19 August 1992, Pei-Gui Liu & Ming-Sheng Yuan 1477 (HKAS 25704).

Notes: *Albatrellus flettii* can be easily recognized by grayish blue pileus surface, apricot tubes, clamped hyphae and small amyloid basidiospores.

Albatrellus fumosus H.D. Zheng & P.G. Liu **sp. nov.** (Figs 1-3)

Mycobank: 511683

Etymology: “fumosus” means gray with brown tints, referring to the color of the pileus surface.

Fructificatio confluens; usque ad 20 cm diam vel etiam magnibus in fasciculatibus. *Pileus* flabelliformis usque ad petaloideae, ravidus usque ad cinereo-brunneus, pallidus latericiescens vel atro-sanguinolentescens ubi contuses, glaber. *Hyphae* generatariae non fibulatae. *Basidiospae* late ellipsoideae, $3.5-4.2(-4.5) \times 2.5-3.3(-3.5) \mu\text{m}$ [n = 90, $Q = (1.17-1.23-1.4(-1.46))$; $Q = 1.32 \pm 0.05$], amyloidae.

Basidiomes terrestrial, annual, fasciculate, up to 20 cm or even larger in clusters. *Pileus* flabelliform or irregular, sometimes petaloid, grayish white, brownish white, pale gray to grayish brown, discoloring pale brick red or pale dirty blood red when bruised, squamulose, azonate, margin even or involute. *Stipe* eccentric to lateral, rarely central, 5-10 cm long, 0.7-2.5 cm thick, often fused at base, white or with tints of pileus surface. *Tubes* white, discoloring pale dirty blood red with purplish tint when bruised, decurrent, 0.1 cm

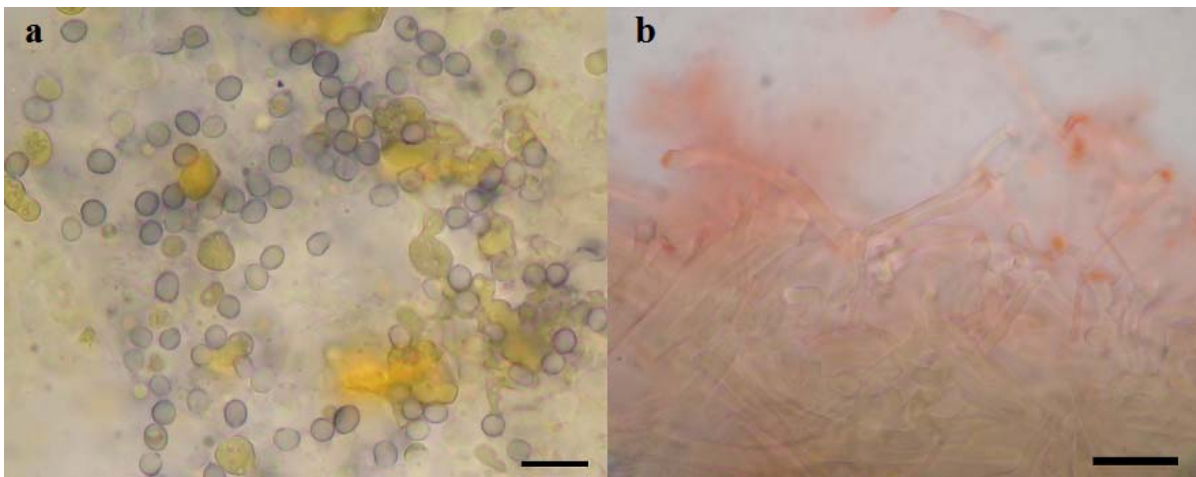


Fig. 2. *Albatrellus fumosus* H.D. Zheng & P.G. Liu (HKAS 48289, **holotype**). **a.** Basidiospores in Melzer's reagent. **b.** Pileipellis hyphae in Congo red. Bars: a = 10 μm , b = 20 μm .

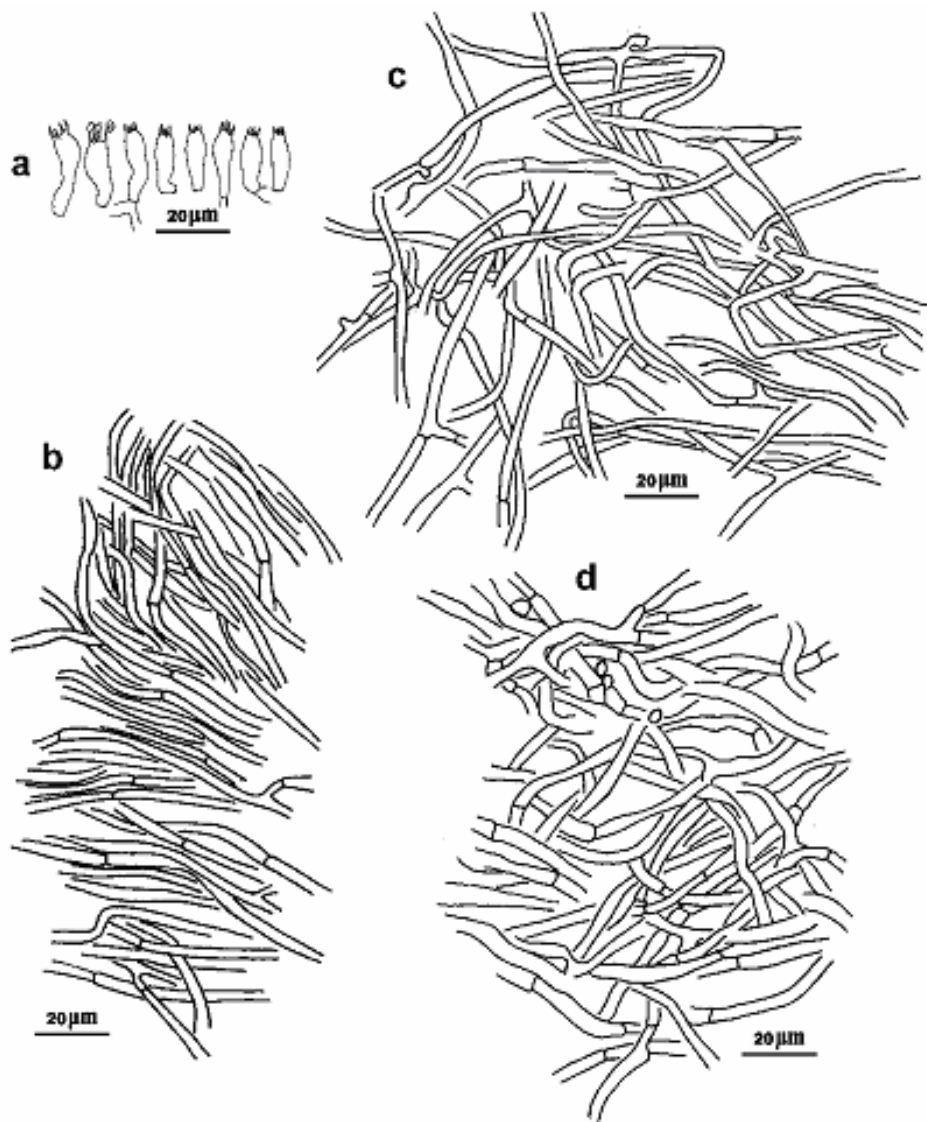


Fig. 3. *Albatrellus fumosus* H.D. Zheng & P.G. Liu (HKAS 48289, **holotype**). **a.** Basidia. **b.** Tramal hyphae. **c.** Stipe basal hyphae. **d.** Contextual hyphae.

long. *Pores* circular to more or less angular, 5-6/mm. *Context* white, fragile, up to 1cm thick, taste a little bitter.

Hyphal system monomitic, simple septate. *Tramal hyphae* hyaline, thin-walled, non-amyloid, 3 µm in diam. *Contextual hyphae* thin-walled, non-amyloid, 4-5 µm in diam. *Pileipellis hyphae* ends of finger shape, thick-walled, 5-8 µm in diam. *Stipe basal hyphae* non-amyloid, thin-walled, 3µm in diam.

Basidia simple-septate at base, cylindrical, 16-22 × 5-6 µm, 4-sterigmata, up to 4 µm long.

Basidiospores hyaline, smooth, amyloid, broadly ellipsoid, 3.5-4.2(-4.5) × 2.5-3.3(-3.5) µm [90 basidiospores, $Q = (1.17-1.23-1.4(-1.46))$; $Q = 1.32 \pm 0.05$].

Known distribution: Yunnan.

Material examined: CHINA, Yunnan: Nanhua wild edible mushroom market, 14 August 2004, Huandi Zheng 04-575 (holotype in KUN (HKAS 48289)); Wuding, Changchong, 14 August 1999, Xiang-Hua Wang 782 (HKAS 35840); Nanhua wild edible mushroom market, 16 August 2004, Huan-Di Zheng 04-583 (HKAS 48287); Wuding wild edible mushroom market, 10 IX 2004, Huan-Di Zheng 04-678 (HKAS 48288); Nanhua wild edible mushroom market, 3 August 2005, Huan-Di Zheng 05-927 (HKAS 49758); Nanhua wild edible mushroom market, 4 August 2005, Huan-Di Zheng 05-930 (HKAS 49761).

Notes: The diagnostic characters of *A. fumosus* are fasciculate basidiomes, grayish brown pileus surface, discoloring pale dirty blood red when bruised, white pores, discoloring pale dirty blood red with purplish tint when bruised, simple-septate hyphae, amyloid basidiospores, 3.5-4.5 × 2.5-3.5 µm. This species has in recent years been found many times in large amounts at the markets of Yunnan Province. However it had not been collected by mycologists in the field until now.

Albatrellus microcarpus H.D. Zheng & P.G. Liu sp. nov. (Figs 4, 5)
MycoBank: 511684

Etymology: “microcarpus” refers to the small basidiome.

Fructificatio solitaria. *Pileus* cinereo-albidus vel plus minusve irregularibus et luteol-coloribus, squamulosae fibrillosae et brunneae, usque ad 2 cm lato. *Pori* angulati, 3-4 per mm, in sicco rubi-brunneus. *Hyphae* generatoriae non fibulatae. *Basidiosporae* late broadly ellipsoideae, (3-3.4-4.3(-4.6) × 2.6-3.3(-3.5) µm [n = 50, $Q = (1.13-1.17-1.4(-1.53))$, $Q = 1.29 \pm 0.08$], amyloideae.

Basidiomes single, small. *Pileus* circular, a little irregular, grayish white with yellowish

tints, covered by brownish fibrillose squamules, 2 cm in diam. *Stipe* eccentric, 2 × 0.3 cm, reddish black to blackish, mostly covered by decurrent tubes. *Tubes* decurrent, reddish brown, 0.15cm long. *Pores* angular, 3-4/mm. *Context* reddish brown to nearly black, 2 mm thick.

Hyphal system monomitic, generative hyphae simple septate. *Tramal hyphae* thin-walled, 2.5-4 µm in diam. *Context hyphae* thin-to thick-walled, most 5-12 µm in diam. some inflated to 20 µm. *Pileipellis hyphae* repent, thick-walled, a layer of the pileus surface up to 100-150 µm thick all distinctly amyloid.

Basidiospores broadly ellipsoid, hyaline, smooth, (3-3.4-4.3(-4.6) × 2.6-3.3(-3.5) µm [n=50, $Q = (1.13-1.17-1.4(-1.53))$, $Q = 1.29 \pm 0.08$], amyloid.

The description is based on dry specimens.

Known distribution: Yunnan.

Material examined: CHINA, Yunnan: Lijiang, Yulong snow mountain, 6 September 1986, R.H. Petersen 56375 (holotype in KUN (HKAS 20134)).

Notes: The distinguishing features of *A. microcarpus* are pale yellowish white pileus surface, covered by fibrillose brown squamules, dark reddish brown pores in dry specimens, simple-septate hyphae, and amyloid basidiospores, 3-4.5 × 2.5-3.5µm.

Albatrellus ovinus (Schaeff.) Kotl. & Pouzar, Česká Mykol. 11(3): 154 (1957).

Basionym: *Boletus ovinus* Schaeff., Fung. Bavar. Palat.4: 83 (1774).

Known distribution: East Asia, North America and Europe (Gilbertson and Ryvarden, 1986-1987; Ryvarden and Gilbertson, 1993; Núñez and Ryvarden, 2001); in China known from Yunnan, Sichuan and Tibet (Mao, 1998).

Material examined: YUNNAN: Zhongdian, Dabao temple, alt. 3200m, under *Picea*, 20 IX 1993, Mu Zang 11995 (HKAS 26981).

Notes: *A. ovinus* is different from other species by the creamy white pileus, simple-septate hyphae, small non-amyloid basidiospores and habitat under *Picea*.

Albatrellus peckianus (Cooke) Niemelä, Ann. Bot. Fenn. 7(1): 54 (1970).

Basionym: *Polyporus peckianus* Cooke, Trans. & Proc. Bot. Soc. Edinb. 13: 148 (1879).

Known distribution: East Asia and North America (Gilbertson and Ryvarden, 1986;



Fig. 4. *Albatrellus microcarpus* H.D. Zheng & P.G. Liu (HKAS 20134, holotype). Dry specimens.

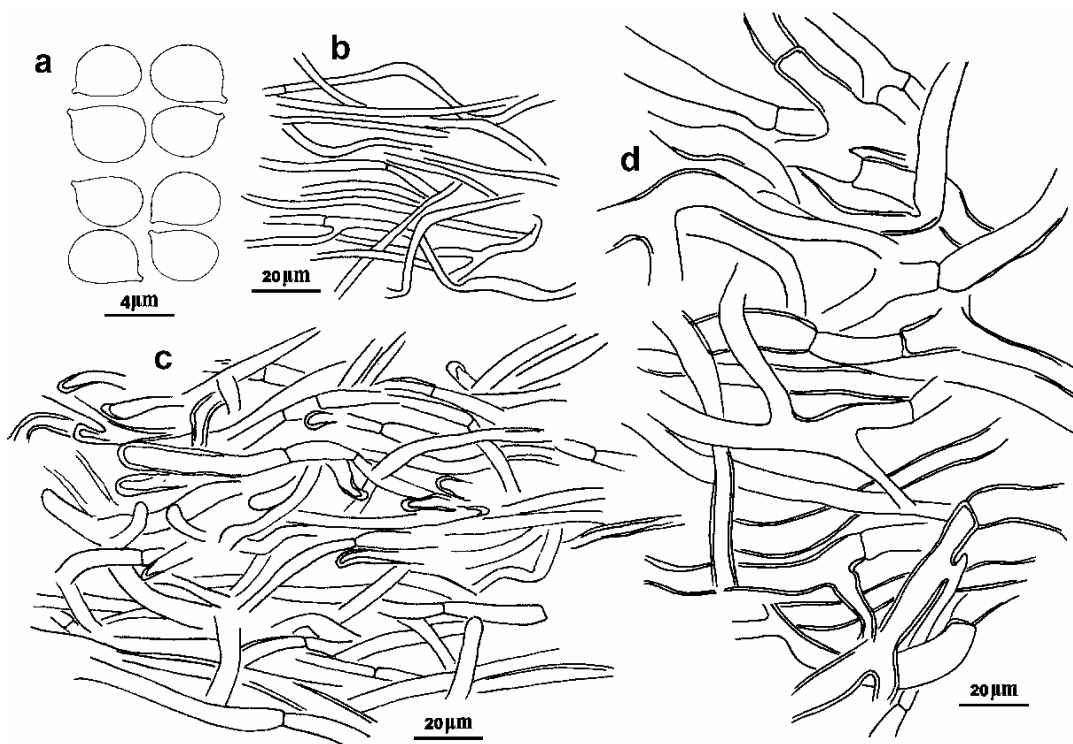


Fig. 5. *Albatrellus microcarpus* H.D. Zheng & P.G. Liu (HKAS 20134, holotype). a. basidiospores. b. tramal hyphae. c. pileipellis hyphae. d. contextual hyphae.

Núñez and Ryvarde, 2001); in China known from Qinghai (Deng, 1963).

Material examined: **QINGHAI:** Qilian, Zhamashi, alt. 2900m, under *Picea* forest, 30 July 1958, Qi-Ming Ma 561 (HMAS 23806).

Notes: *A. peckianus* is distinguished from other species by the pale tan pileus, clamped hyphae, small non-amyloid basidiospores, and habitat under trees.

Albatrellus pes-caprae (Pers.) Pouzar, Fol. Geobot. Phytotax. 1: 357 (1966).

Basionym: *Polyporus pes-caprae* Pers., Traité sur les Champignons Comestibles (Paris): 241 (1818).

Known distribution: East Asia, North America, Europe (Gilbertson and Ryvarde, 1986-1987; Ryvarde and Gilbertson, 1993; Núñez and Ryvarde, 2001) and New Zealand (Cunningham, 1965); in China known from Yunnan, Sichuan, Jiangxi, Fujian and Zhejiang (Zhang, 1999).

Material examined: **YUNNAN:** Wuding wild mushroom market, 12 August 1999, Xiang-Hua Wang 734 (HKAS 35820); Wuding wild mushroom market, 10 September 2004, Huan-Di Zheng 04-677 (HKAS 48312); Wuding, Shizishan, under *Pinus yunnanensis*, alt. 2400m, 22 August 2000, Fu-Qiang Yu 302 (HAKS 38854).

Notes: *A. pes-caprae* is characterized by brown pileus with fibrillose scales, clamped hyphae and large non-amyloid basidiospores.

Albatrellus skamanius (Murrill) Pouzar, Česká Mykol. 26: 199 (1972).

Basionym: *Scutiger skamanius* Murrill, Mycologia 38: 348 (1946).

Known distribution: U.S.A. (Washington) and China (Yunnan).

Material examined: **YUNNAN:** Nanhua wild mushroom market, 9 August 2000, Xiang-Hua Wang 1156 (HKAS 37109).

Notes: *A. skamanius* can be easily recognized by its unique fuliginous to black pileus, clamped hyphae and large non-amyloid basidiospores.

Albatrellus subrubescens (Murrill) Pouzar, Česká Mykol. 26: 196 (1972).

Basionym: *Scutiger subrubescens* Murrill, Bull. Torrey Bot. Club 67: 277 (1940).

Known distribution: China, North America and Europe (Gilbertson and Ryvarde, 1986-1987; Ryvarde and Gilbertson, 1993); in China known from Yunnan and Tibet.

Material examined: **YUNNAN:** Chuxiong, Zixi mountains national forest park, alt. 2380m, 15 August

2004, Huan-Di Zheng 04-579 (HKAS 48313); Chuxiong, Zixi mountains national forest park, alt. 2380m, 15 August 2004, Huan-Di Zheng 04-580 (HKAS 48314); **TIBET:** Bomi, Guxiang, alt. 2700-2800m, under conifer forest, 31 August 1982, Xiao-Lan Mao 249 (HMAS 50943); Motuo, under conifer forest, alt. 3200 m, 26 August 1983, Xiao-Lan Mao 1558 (HMAS 50959).

Notes: *A. subrubescens* can be differentiated from other species by its white pileus becoming orange when bruised, simple-septate hyphae, small amyloid basidiospores, and habitat under *Pinus*.

Albatrellus syringae (Parmasto) Pouzar, Fol. Geobot. Phytotax. 1: 358 (1966).

Basionym: *Scutiger syringae* Parmasto, Botanicheskie Materialy 15: 132 (1962).

Known distribution: China (Cui *et al.*, 2008), North America and Europe (Ryvarde and Gilbertson, 1993; Ginns, 1997); in China known from Qinghai.

Material examined: **QINGHAI:** Qilian, N 38.10°, E 100.12°, on ground, 3 August 1996, Xiao-Lan Mao, Shu-Xiao Sun & Hua-An Wen 9076 (HMAS 76980).

Notes: Its diagnostic characters are the yellow to ochraceous pileus, clamped hyphae, small non-amyloid basidiospores and habitat in lawn.

Albatrellus tianschanicus (Bondartsev) Pouzar, Fol. Geobot. Phytotax. 1: 358 (1966).

Basionym: *Scutiger tianschanicus* Bondartsev, Botanicheskie Materialy 13: 220 (1960).

Known distribution: China and central part of USSR (Ryvarde and Gilbertson, 1993; Zheng *et al.*, 2004); in China known from Xinjiang, Gansu and Sichuan.

Material examined: **SICHUAN:** Hongyuan, Shuama road crossing, alt. 3300m, 23 August 1991, Ming-Sheng Yuan 1695 (HKAS 23855); **GANSU:** Zhouqu, Shatan logging centre, alt. 2600m, 18 August 1998, Ming-Sheng Yuan 3822 (HKAS 33597); Longnan, August 1992, Mao-Lin Tian M6484 (HMAS 61519); Diebu October 1991, Mao-Lin Tian 6482 (HMAS 61716); **XINJIANG:** Zhaosu, Muzhaer river, under *Picea* forest, alt. 2300m, 12 August 1978, Xiao-Lan Mao 477 (HMAS 39415).

Notes: *A. tianschanicus* is different from other species by its squamulose pileus, the light orange stipe with a black base, simple-septate hyphae and small amyloid basidiospores.

Albatrellus tibetanus H.D. Zheng & P.G. Liu **sp. nov.** (Figs 6, 7)

Mycobank: 511685

Etymology: "tibetanus" referring to Tibet, the locality of the holotype.



Fig. 6. *Albatrellus tibetanus* H.D. Zheng & P.G. Liu (HKAS 45729, **holotype**). **a.** fresh basidiomes. **b-d.** dry specimens.

Fructificatio caespitosa. Pileus dense atro-vel penitus brunneus squamulosus, 5-9 cm lato. *Stipes* brevis, tantum 2-3 × 2-3 cm, tenuiascens versus basin, albidus usque ad brunneus. *Hyphae* generativae non fibulatae. *Basidiosporae* late ellipsoideae, (3.8-)4-4.8(-5) × (2.8-)3-3.8(-4) μm [n=60, $Q = (1.14-)$ 1.17-1.39 (-1.41), $Q = 1.29 \pm 0.06$], amyloideae.

Basidiomes caespitose. *Pileus* 5-9 cm in diam. often irregular formed, white to cream, becoming pale brown after drying, aerolate, densely colored with blackish to deep brown squamules. *Stipe* short, 2-3 × 2-3 cm, tapering toward the base, dirty white to brown. *Tubes* white, shallow, decurrent, *pore* mouth minute, 3-5/mm. *Context* white to cream and easily broken when fresh, in dry specimen brownish and hard, 3 mm thick.

Hyphal system monomitic, generative hyphae with simple septa. *Trametal hyphae* thin-walled, 3-5 μm in diam. *Contextual hyphae* thin- to slightly thick-walled, 5-8 μm in diam. *Pileipellis hyphae* thin-walled, with scattered amyloid patches. *Stipe basal hyphae* interwoven, thin- to slightly thick-walled, 3-5 μm in diam, non-amyloid.

Basidiospores hyaline, smooth, thin-walled, broadly ellipsoid, amyloid, (3.8-)4-4.8(-5) × (2.8-)3-3.8(-4.0) μm [60 basidiospores, $Q = (1.14-)$ 1.17-1.39(-1.41), $Q = 1.29 \pm 0.06$].

Habitat: in *Picea* forest.

Known distribution: Tibet.

Material examined: **CHINA, Tibet**, Leiwuqi, 31°16.504'N, 96°37.538'E, on the ground in *Picea* forest, 10 August 2004, Zhu-Liang Yang 4350 (**holotype in KUN** (HKAS 45729)).

Notes: *A. tibetanus* can be distinguished from other *Albatrellus* species by its cream to pale brown squamulose pileus, white tubes, simple-septate hyphae, and amyloid basidiospores, 3.5-5 × 2.5-4 μm.

Albatrellus yasudae (Lloyd) Pouzar, *Česká Mykol.* 26: 199 (1972).

Basionym: *Polyporus yasudae* Lloyd [as 'yasudai'], *Mycol. Writ.* 4(Letter 44): 10 (1913).

Known distribution: China and Japan (Pouzar, 1972; Núñez and Ryvarden, 2001); in China known from Yunnan (Mao, 1998).

Material examined: **YUNNAN**: Wuding, Chadian, in mixed forest, alt. 2380m, 6 August 1998,

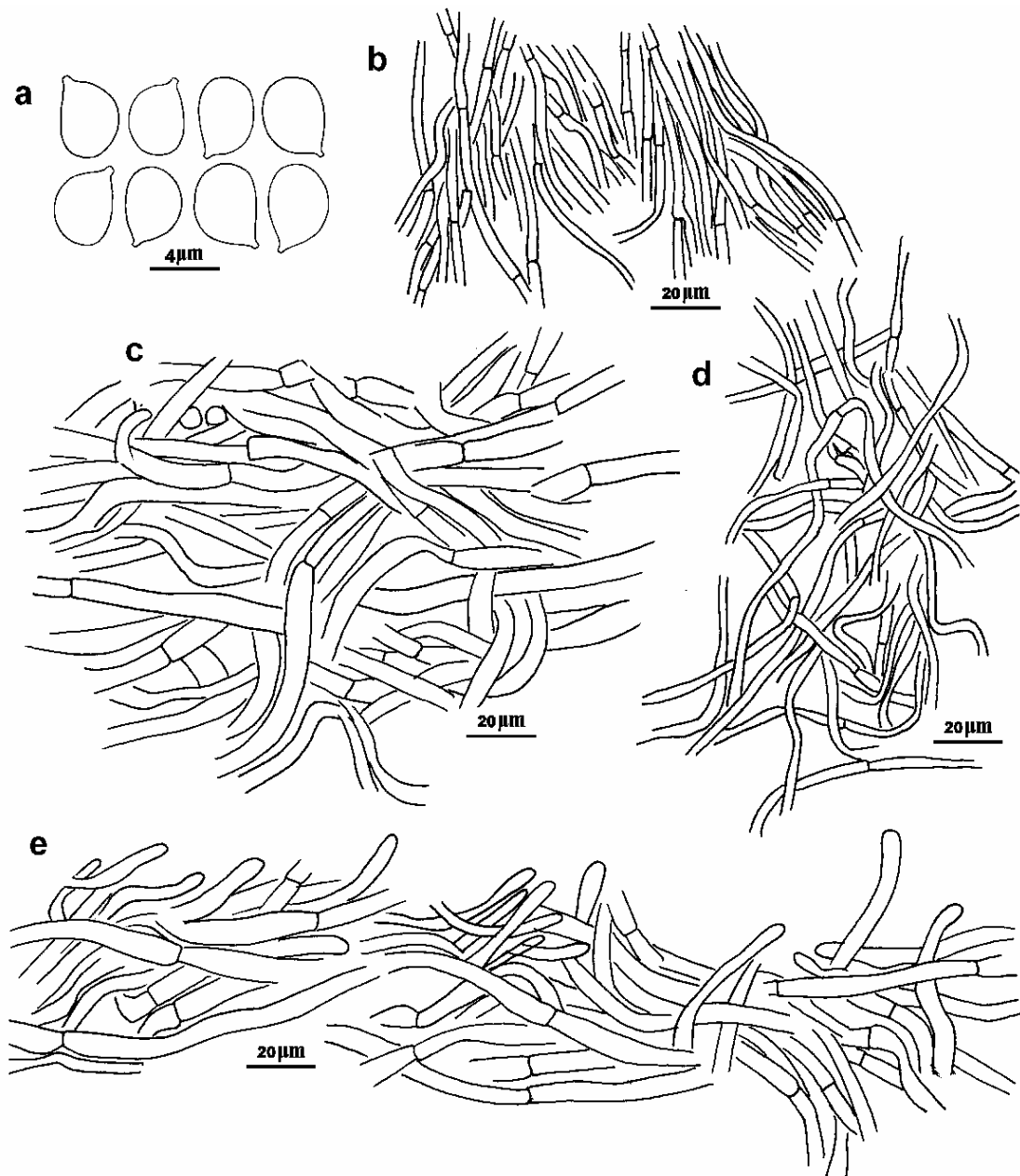


Fig. 7. *Albatrellus tibetanus* H.D. Zheng & P.G. Liu (HKAS 45729, **holotype**). **a.** basidiospores. **b.** trametal hyphae. **c.** contextual hyphae. **d.** stipe basal hyphae. **e.** pileipellis hyphae.

Xiang-Hua Wang 657 (HKAS 35766); Chuxiong, Zixi mountains national forest park, 13 August 2004, Huan-Di Zheng 04-558a (HKAS 48315); Nanhua wild edible mushroom market, 14 August 2004, Huan-Di Zheng 04-574 (HKAS 48316).

Notes: The diagnostic characters of *A. yasudae* are its unique, viscid, brown to black pileus surface, glossy after drying, simple-septate hyphae and small non-amyloid basidiospores.

Albatrellus yunnanensis H.D. Zheng & P.G. Liu, Mycotaxon 97: 146 (2006).

Known distribution: China (Zheng, 2006; Zheng and Liu, 2006).

Material examined: **YUNNAN:** Dali, September 1983, Yu Xuan (HKAS 12092); Nanhua wild mushroom market, 3 August 1998, Xiang-Hua Wang 619 (HKAS 32906); Nanhua wild mushroom market, 9 September 2000, Xiang-Hua Wang 1154 (HKAS 37107, holotype!); Nanhua wild mushroom market, 12 July 2001, Xiang-Hua Wang 1231 (HKAS 39167); Nanhua wild mushroom market, 16 August 2004, Huan-Di Zheng 04-585 (HKAS 48311).

Notes: *A. yunnanensis* is characterized by olivaceous yellow to dull ochraceous yellow

glabrous to squamulose, pileus surface, clamped hyphae, and large non-amyloid basidiospores.

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References

- Albee-Scott, S. (2007). The phylogenetic placement of the *Leucogastrales*, including *Mycolevis siccigleba* (Cribbeaceae), in the *Albatrellaceae* using morphological and molecular data. *Mycological Research* 111: 653-662.
- Bi, Z.S., Zheng, G.Y. and Li, T.H. (1994). *Macrofungus Flora of Guangdong Province*. Guangdong Science and Technology Press, Guangzhou, China. [in Chinese].
- Bruns, T.D., Szaro, T.M., Gardes, M., Cullings, K.W., Pan, J.J., Taylor, D.L., Horton, T.R., Kretzer, A., Garbelotto, M. and Li, Y. (1998). A sequence database for the identification of ectomycorrhizal basidiomycetes by phylogenetic analysis. *Molecular Ecology* 7: 257-272
- Chaumont, J.P. and Simeray, J. (1982). Antifungal properties of 225 *Basidiomycetes* and *Ascomycetes* with respect to 7 pathogenic fungi culture in vitro. *Cryptogamie Mycologie* 3: 249-259.
- Cui, B.K. Wang, Z. and Dai, Y.C. (2008). *Albatrellus piceiphilus* sp. nov. on the basis of morphological and molecular characters. *Fungal Diversity* 28: 41-48.
- De, A.B. (2005). *Albatrellus ginnsii* sp. nov. *Mycotaxon* 93: 123-128.
- Deng, S.Q. (1963). *Fungi of China*. Science Press, Beijing, China. [in Chinese].
- Ding, Z.H., Dong, Z.J. and Liu, J.K. (2001). Albaconol, a novel prenylated resorcinol (= Benzene-1,3-diol) from *Basidiomycetes Albatrellus confluens*. *Helvetica Chimica Acta* 84: 259-262.
- Gilbertson, R.L. and Ryvarden, L. (1986). *North American polypores*. Vol.1. Fungiflora, Oslo, Norway. 1-433.
- Ginns, J. (1997). The taxonomy and distribution of rare or uncommon species of *Albatrellus* in western North America. *Canadian Journal of Botany*, 75: 261-273.
- Hellwig, V., Nopper, R., Mauler, F., Freitag, J., Liu, J.K., Ding, Z.H. and Stadler, M. (2003). Activities of prenyphenol derivatives from fruitbodies of *Albatrellus* spp. on human and rat vanilloid receptor 1 (VR1) and characterization of the novel natural product, confluentin. *Archiv der Pharmazie Pharmaceutische und Medicinal Chemistry* 336: 119-126.
- Hibbett, D.S. and Binder, M. (2002). Evolution of complex fruiting-body morphologies in Homobasidiomycetes. *Proceedings of the Royal Society of London Series B-Biological Sciences* 269: 1963-1969.
- Hibbett, D.S., Nilsson, R.H., Snyder, M., Fonseca, M., Costanzo, J. and Shonfeld, M. (2005). Automated Phylogenetic Taxonomy: An Example in the *Homobasidiomycetes* (Mushroom-Forming Fungi). *Systematic Biology* 54: 660-668.
- Hirata, Y. and Nakanishi, K. (1950). Grifolin, an antibiotic from a Basidiomycete. *Journal of Biological Chemistry* 184: 135-143.
- Holmgren, P.K., and Holmgren N.H. (1998). [continuously updated]. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. <http://sweetgum.nybg.org/ih/>
- Kawagishi, H., Tanaka, A., Sugiyama, K., Mori, H., Sakamoto, H., Ishiguro, Y., Kobayashi, K. and Uramoto, M. (1996). A pyridine-derivative from the mushroom *Albatrellus confluens*. *Phytochemistry* 42: 547-548.
- Kirk, P.M., Cannon, P.F., David, J.C. and Stalpers, J.A. (eds) (2001). *Ainsworth & Bisby's dictionary of the fungi*. 9th edn. Oxon: CAB INTERNATIONAL.
- Mao, X.L. (1998). *Economic Fungi of China*. Science and Technology Press, Beijing, China. [in Chinese].
- Miller, O.K., Jr and Miller, H.H. (1980). *Mushrooms in Color*. New York: E P BUTTON.
- Miller, S.L., Larsson, E., Larsson, K.H., Verbeken, A. and Nuytinck, J. (2006). Perspectives in the new *Russulales*. *Mycologia* 98: 960-970.
- Nukata, M., Hashimoto, T., Yamamoto, I., Iwasaki, N., Tanaka, M. and Asakawa, Y. (2002). Neogrifolin derivatives possessing anti-oxidative activity from the mushroom *Albatrellus ovinus*. *Phytochemistry* 59: 731-737
- Núñez, M. and Ryvarden, L. (2001). *East Asian Polypores*. Fungiflora Oslo. Norway
- Qing, C., Liu, M.H., Yang, W.M., Zhang, Y.L., Wang, L. and Liu, J.K. (2004). Effects of Albaconol from the basidiomycete *Albatrellus confluens* on DNA topoisomerase II - mediated DNA cleavage and relaxation. *Planta Medica* 70: 1-5.
- Ryman, S., Fransson, P., Johannesson, H. and Danell, E. (2003). *Albatrellus citrinus* sp. nov., connected to

- Picea abies* on lime rich soils. Mycological Research 107: 1243-1246.
- Ryvarden, L. and Johnsen, I. (1980). *A preliminary Polypore flora of (east) Africa*. Fungiflora Oslo. Norway.
- Ryvarden, L. and Gilbertson, R.L. (1993). *European polypores. Vol.1*. Fungiflora.Oslo. Norway.
- Wang, X.H. and Liu, P.G. (2002). *Resources investigation and studies on the wild commercial fungi in Yunnan*. Biodiversity Science 10: 318-325 [in Chinese].
- Wang, X.H., Liu, P.G. and Yu, F.Q. (2004). *Color atlas of wild commercial mushrooms in Yunnan*. Yunnan Science and Technology Press, Kunming, China. [in Chinese].
- Yang, W.M., Liu, J.K., Chen, Q., Liu, Y.D., Ding, Z.H., Shen, Z.Q. and Chen, Z.H. (2003). Albaconol from the mushroom *Albatrellus confluens* induces contraction and desensitization in guinea pig trachea. *Planta Medica* 69: 715-719.
- Yang, Z.L. and Zhang, L.F. (2003). Type studies on *Clitocybe macrospora* and *Xerula furfuraceae* var. *bispora*. *Mycotaxon* 88: 447-454.
- Yuan, M.S. and Sun, P.Q. (1995). *Macrofungi of Sichuan*. Sichuan Science and Technology Press, China. [in Chinese].
- Zhang, G.Y. (1999). *Atlas of familiar edible mushrooms in China*. Yunnan Science and Technology Press, China. [in Chinese].
- Zhao, J.D., Zhang, X.Q. and Xu, L.W. (1998). *Flora Fungorum Sinicorum, Vol.3-Polyporaceae*. Science Press, Beijing, China. [in Chinese]
- Zheng, G.Y., Zhang, W.M., Li, T.H. and Lai, J.P. (1992). The genus *Albatrellus* of Guangdong and Hainan Provinces. *Acta Mycologica Sinica* 11: 107-110.
- Zheng, H.D., Liu, P.G., Wang, X.H. and Yu, F.Q. (2004). Four new records in the genus *Albatrellus* (*Aphyllphorales*, *Albatrellaceae*) from China. *Mycotaxon* 90: 291-299.
- Zheng, H.D. and Liu, P.G. (2005). Type studies on *Albatrellus henanensis* and *A. jianfenglingensis*. *Mycotaxon* 93: 257-263.
- Zheng, H.D. (2006). *Studies on the Taxonomy and Phylogeny of Albatrellaceae Nuss (Polyporales, Basidiomycetes, Basidiomycota)*. Ph.D. thesis. Kunming Institute of Botany, Chinese Academy of Sciences, China.
- Zheng, H.D. and Liu, P.G. (2006). *Albatrellus yunnanensis*, a new species from China. *Mycotaxon*: 97: 145-151.
- Zmitrovich, I.V., Malysheva, V.F. and Spirin, W.A. (2006). A new morphological arrangement of the *Polyporales*. I. *Phanerochaetinae*. *Mycena* 6: 4-56.